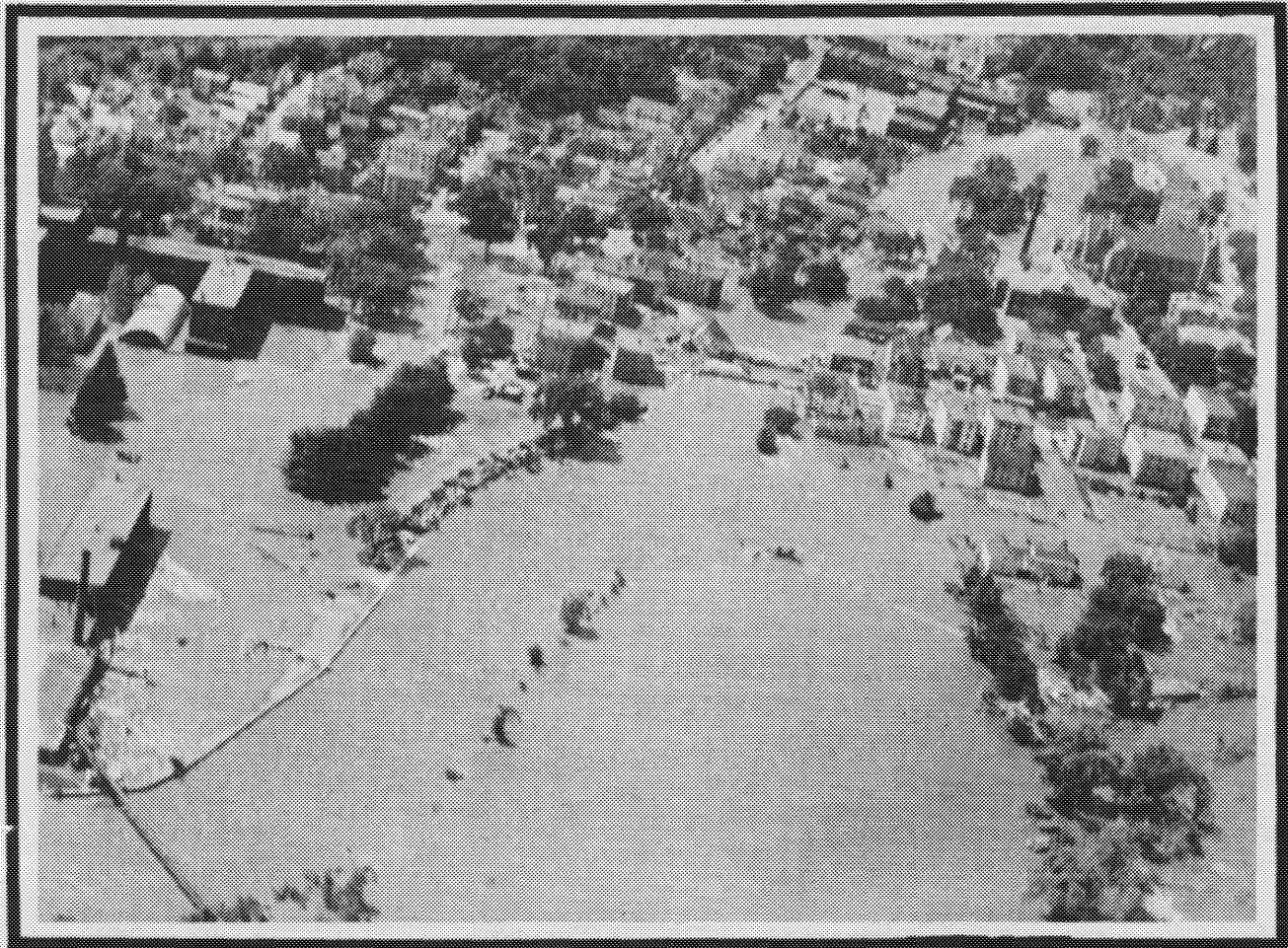


FLOOD PLAIN INFORMATION

QUINEBAUG RIVER — CADY BROOK

TOWN OF SOUTHBRIDGE, MASSACHUSETTS



PREPARED FOR THE TOWN OF SOUTHBRIDGE BY THE DEPT. OF THE ARMY, NEW ENGLAND DIV.,
CORPS OF ENGINEERS, WALTHAM, MASS.

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INTRODUCTION

This report relates to the flood situation along the Quinebaug River and Cady Brook in Southbridge, Massachusetts. It was prepared at the request of the Massachusetts Water Resources Commission to aid in the solution of local flood problems and in the best utilization of land subject to overflow. The report is based upon information on rainfall, runoff, historical flood heights, bridges and other technical data pertinent to the frequency and size of floods on the Quinebaug River and Cady Brook. It is intended to encourage those affected to help themselves.

Two phases of the flood situation along the streams are covered in this report. The first relates a record of the largest known historic floods in the area. The second discusses the probability of future floods of various magnitudes including the Intermediate Regional Flood and the Standard Project Flood. These floods are defined on page 3.

On the Quinebaug River, floods are modified by the two existing flood control reservoirs, East Brimfield and Westville. On Cady Brook, however, the stream is without benefit of flood control reservoirs.

In problems concerned with the control of developments in the flood plains of Quinebaug River and Cady Brook and in reaching decisions on the size of floods to consider for this purpose, appropriate consideration should be given to the possible future occurrence of floods of the size of the Intermediate Regional Flood, and the Standard Project Flood.

Maps and profiles which indicate the extent of flooding that has been experienced and that which might occur in the future, in the report area, are included in this report. From these, the depth of probable flooding at any location may be learned. With this information, floor levels for buildings may be planned high enough to avoid flood damage or, at lower elevations, with recognition of the chance and hazards of flooding that are being taken.

The report does not include plans for the solution of flood problems. Rather, it is intended to provide the basis for further study and planning on the part of the town in arriving at solutions to minimize vulnerability to flood damages. This involves local planning programs to guide developments by controlling the type of use made of the flood plain through zoning and subdivision regulations, the construction of flood protection works, or a combination of the two.

It is not intended to extend any Federal authority over zoning or other regulation of flood plain use, and the report is not to be construed as committing the Federal government in the future to investigate, plan, design, construct any facilities discussed, or to imply any intent to undertake such activities unless specifically authorized by Congress. It is intended, as mentioned before, as an aid to local authorities.

The New England Division of the Corps of Engineers will, upon request, provide technical assistance to Federal, state and local agencies in the use of the information contained herein and will provide other pertinent data which are available.

SUMMARY OF FLOOD SITUATION

The town of Southbridge is located on the Quinebaug River in the south-central part of Massachusetts at the upper portion of the Thames River basin. This report covers approximately 5 miles of the Quinebaug River from the Dudley town line upstream to Westville Dam, and about 1.8 miles of Cady Brook from the Quinebaug River to the Charlton town line which is shown on Plate 1. Plate 2 shows the location of Southbridge in the upper part of the Quinebaug River basin.

The U. S. Geological Survey maintains a gaging station on the Quinebaug River 200 feet downstream of Westville Dam and about 1 mile upstream of McKinstry Brook. The first records of river stages and discharges date back to July 1939. Flows are regulated by East Brimfield and Westville Dams and by other reservoirs above the station. Residents along the streams have been interviewed and newspaper files and historical documents searched for information concerning past floods. The operating procedures for Westville and East Brimfield flood control projects have been reviewed and from these investigations and from studies of possible future floods on the Quinebaug River and Cady Brook, the local flood situation, both past and future, has been developed. The

following paragraphs summarize the significant findings which are discussed in more detail in succeeding sections of this report.

* * *

THE GREATEST FLOOD known to have occurred on the Quinebaug River and Cady Brook occurred in August 1955 when hurricane "Diane" deposited record amounts of precipitation on regions previously saturated by hurricane "Connie". Flooding in South-bridge was further increased by the failure of the Old Globe Tool and Die Company Dam on the Quinebaug River and Glenecho Dam on Cady Brook in Charlton which in turn destroyed several small dams.

* * *

ANOTHER GREAT FLOOD in September 1938 was the second highest flood on the Quinebaug River and resulted from an intense storm preceding a disastrous hurricane.

* * *

OTHER GREAT FLOODS on the Quinebaug River occurred in March 1936 and February 1886 with the latter approximately equal to the March 1936 flood.

* * *

INTERMEDIATE REGIONAL FLOODS on the Quinebaug River and Cady Brook are floods that have an average frequency of occurrence in the order of once in 100 years or, in other words, in each year there is a 1 percent chance of occurrence. They are determined from an analysis of floods on those streams and other streams in the same general area. The analysis indicates that the Intermediate Regional Flood for the Quinebaug River varies from zero to approximately three feet lower than the modified 1955 flood and for Cady Brook varies from zero to three feet lower than the recurring 1955 flood without dam failure.

* * *

STANDARD PROJECT FLOOD on the Quinebaug River and Cady Brook represents an estimated flood condition which is considered to be possible. It is not practical to assign a frequency to the Standard Project Flood as the occurrence of such a flood would be a rare event, however, it could occur in any year. In this study the flood would have a stage on the Quinebaug River between zero to one foot higher than the modified August 1955 flood. On Cady Brook this flood will vary from zero to three feet above the experienced August 1955 flood assuming there are no dam failures on the brook.

* * *

MAIN FLOOD SEASON on the Quinebaug River is in the spring, usually resulting from spring rains combined with melting snow. However, records reveal that the two highest floods were the results of hurricane-type storms in August and September.

* * *

FLOOD DAMAGE PREVENTION MEASURES in the Quinebaug River basin, as well as in other drainage areas in New England, has been an active program of the New England Division, Corps of Engineers. The existing flood control reservoirs, East Brimfield and Westville control 80 percent of the drainage area of the Quinebaug River and will prevent serious flooding in the town of Southbridge. The Commonwealth of Massachusetts widened and deepened the channel of Cady Brook and constructed 1100 feet of concrete retaining walls in the vicinity of Charlton Street. However, on the uncontrolled Cady Brook the area is still susceptible to flooding.

* * *

FLOOD HEIGHTS of the September 1938, the March 1936, the Intermediate Regional and Standard Project Floods related to the most recent major flood which occurred in August 1955 are shown in Table 1. The table shows the comparison of the flood heights along the Quinebaug River at the Mechanic Street and River Street Bridges.

TABLE 1
RELATIVE FLOOD HEIGHTS

<u>Flood</u>	Below August 1955 Flood	
	In Feet	
	<u>Mechanic Street Bridge</u>	<u>River Street Bridge</u>
August 1955	0	0
September 1938	6.5	5.1
March 1936	10.5	4.8
Intermediate Regional (1)	8.5	9.8
Standard Project (1)	6.8	8.7

(1) Modified by Westville and East Brimfield Dams.

GENERAL CONDITIONS AND PAST FLOODS

GENERAL

This section of the report is a history of floods on the Quinebaug River and its tributary, Cady Brook, in the vicinity of the town of Southbridge, in Worcester County, Massachusetts. Plate 2 shows the location of Southbridge which is in the southern central part of the Commonwealth and in the upper Quinebaug River basin. The portion of Quinebaug River studied covers approximately 5 miles from the Dudley town line upstream to Westville Dam, and about 1.8 miles of Cady Brook from the Quinebaug River at Station 140+00 in the town of Southbridge

to the Charlton town line as shown on Plate 1. The first records of river stages and discharges date back to July 1939. Flows are regulated by East Brimfield and Westfield Dams and by other reservoirs above the station.

Since about 1690, when the region was first settled, at least 15 major floods have occurred in the Quinebaug River basin. The three earliest known floods occurred in 1720, 1784 and 1789.

Investigations were made following all the floods that have taken place since March 1936. Residents along the streams have been interviewed and newspaper files and historical documents searched for information concerning past floods (See Figure 1). Keeping of systematic flood records for the major New England rivers began about 1904. It is fairly certain that the recent floods exceeded all historical floods back to the date of white settlement - some 300 years ago. Even though the magnitudes of the early floods cannot now be determined, the knowledge of their existence is valuable. Table 2 shows a partial list of historical floods (those floods that have occurred before the establishment of gaging stations).

TABLE 2
HISTORICAL FLOODS
QUINEBAUG RIVER BASIN

<u>Year</u>	<u>Month</u>	<u>Year</u>	<u>Month</u>
1720	-	1818	-
1729	February	1828	March
1757	February	1837	-
1767	-	1867	February
1784	-	1869	October
1789	-	1876	March
1801	March	1886	February
1807	February		

Settlement

The Thames River basin was settled early in the 17th century. Southbridge was originally settled in 1730 and incorporated as a town in the year 1816. It was formed from parts of Charlton, Dudley and Sturbridge. The area was not easily adaptable to farming, so the early settlers turned to manufacturing as their chief economic pursuit. Graphite was discovered in the area and as early as 1638 the ore was mined. The oldest auger and bit



MECHANIC STREET
HIGH WATER MARKS - AUGUST 1955

Figure 1

factory in the country was established here in Southbridge and tools made here were used to build the U.S. Frigate Constitution, "Old Ironsides". Southbridge is an industrial community and the leading sources of employment are firms engaged in manufacturing.

The important manufacturing plants in Southbridge are located along the river and include such diversified products as optical goods, cutlery, tools and dies, and textiles. Most of the buildings along Cady Brook are residential with a few commercial enterprises.

Flood Damage Prevention Measures

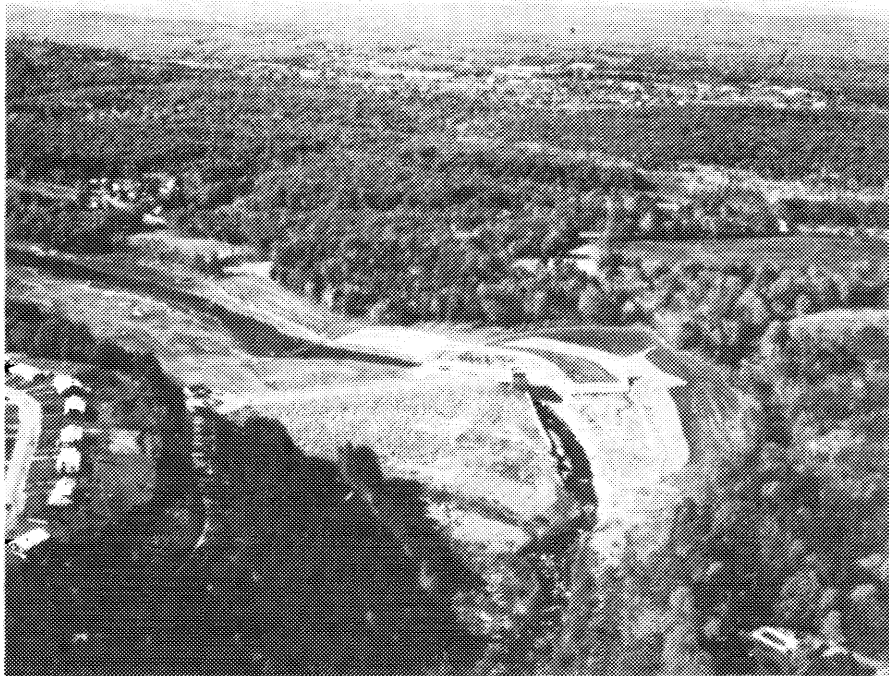
Flood control dams in East Brimfield and Westville have been constructed by the Corps of Engineers on the Quinebaug River upstream of the town of Southbridge (See Figure 2). East Brimfield Dam is located in the town of Sturbridge about one mile southwest of the village of Fiskdale. Construction of the project was initiated in 1958 and completed in June 1960 at a cost of \$7,020,000. The reservoir can store 30,000 acre-feet equivalent to 8.3 inches of runoff from the drainage area of 67.5 square miles. Westville Dam and Reservoir is located in the towns of

Southbridge and Sturbridge. Construction was started in 1960 and completed in 1962 at a cost of \$5,590,000. The reservoir is capable of storing 11,100 acre-feet of floodwaters. This is equivalent to 6.5 inches of runoff from the net drainage area of 32 square miles below East Brimfield Dam.

Flood Warning and Forecasting Service

The U. S. Department of Commerce River Forecast Center at Hartford, Connecticut is responsible for issuing flood warnings for the protection of life and property in the Quinebaug River basin. The flood warnings are issued by teletype simultaneously to the press services, State Police, Civil Defense and many other State and local agencies.

It should be reiterated that a flood warning system is only one phase of preventative flood damage measures. The other phase is the preparation of Federal and local governments and private citizens to combat the impending storm. Without a sufficient storm warning and an ability to react to the warning, the residences, industrial and commercial establishments in low-lying areas will be defenseless against the raging flood waters of the Quinebaug River.



WESTVILLE DAM



EAST BRIMFIELD DAM

FLOOD CONTROL DAMS

Figure 2

In addition to the flood warnings and forecasting services, the Corps of Engineers operates an Automatic Hydrologic Radio Reporting Network. This network, under computer programmed control, will immediately provide read-out information which is essential for the regulation of East Brimfield and Westville Flood Control Reservoirs.

QUINEBAUG RIVER

The Stream and Its Valley

The Quinebaug River rises in the northeast part of the town of Union, Connecticut, at a small pond in the village of Mashpaug at an elevation of 690 feet above mean sea level. The river follows a sinuous course in a general northerly direction for about 8 miles to East Brimfield, Massachusetts, then winding generally south-eastward for about 25 miles to its confluence with the French River at Mechanicsville in the town of Thompson, Connecticut. From there, the Quinebaug River flows more or less south for about 43 miles to empty into the Shetucket River just north of the city of Norwich, Connecticut. The Quinebaug River has a total length of approximately 76 miles with a total fall of 670 feet.

The Quinebaug River watershed has a maximum length of approximately 55 miles, an average width of about 15 miles, and a maximum width of about 23 miles along the Massachusetts-Connecticut border. Its total drainage area of 744 square miles accounts for slightly more than 50 percent of the total drainage area of the entire Thames River basin.

The Quinebaug River basin lies completely within the uplands of New England. The entire basin is maturely eroded with rounded hills rising above relatively narrow valleys. The highest point in the watershed is Mount Pisgah (1,264 feet) in the town of Wales, Massachusetts.

Developments in the Flood Plain

Plates 3, 4, 5 and 6 show the flood plains of Quinebaug River covered in this investigation. There is little development in the flood plains between the Dudley town line and Sandersdale Dam. Between Sandersdale Dam and Cady Brook is the large American Optical plant. Upstream of Cady Brook to the former location of the Globe Tool and Die Company Dam, there would be little flooding. From this point upstream to Westville Dam, the flood plain remains undeveloped.

Bridges Across the Streams

There are eleven bridges crossing the Quinebaug River in the reach covered by the report. Views of some of the bridges are shown in Figure 3. Table 3 lists pertinent elevations for the bridges and shows the relation to the Intermediate Regional Flood and the experienced August 1955 flood.

TABLE 3

BRIDGES ACROSS THE QUINEBAUG RIVER

Station Above Dudley Town Line	Identification	River Bed Elev. ft., msl	Floor Elev. ft., msl	Intermediate Regional Flood Crest ft., msl	August 1955 Flood Crest ft., msl	Underclearance Relating to Intermediate Regional Flood		
						Elev. ft., msl	Above ft.	Below ft.
58+50	Dresser Hill Road	383.5	401.4	397.2	408.0	397.6	0.4	-
105+00	*A. O. Bridge	-	-	412.0	-	414.7	2.7	-
108+00	A. O. Bridge	-	-	412.3	-	421.1	8.8	-
111+50	A. O. Bridge	-	-	413.0	-	421.1	8.1	-
125+70	A. O. Bridge	-	-	420.2	-	429.4	9.2	-
127+00	A. O. Bridge	-	-	420.4	-	429.4	9.0	-
132+70	A. O. Bridge	-	-	421.3	-	428.6	7.3	-
144+00	Mechanic Street	412.5	429.4	425.8	434.3	425.0	-	0.8
157+00	Central Street	419.4	453.2	428.1	456.0	448.8	20.7	-
196+50	River Street	469.4	487.7	479.4	489.2	483.2	3.8	-
208+50	Mill Street	477.1	493.2	483.3	496.1	488.8	5.5	-
211+50	West Main Street	479.1	497.2	485.3	500.9	492.5	7.2	-

*American Optical Co.

Inspection of the water surface profiles on the Quinebaug River indicates that the bridges in general are not major restrictions to flood flows and no bridge will be inundated by the Standard Project Flood. Dresser Hill Road Bridge will be an obstacle to flood flows but will not be overtopped. Mechanic Street Bridge will be an obstruction but will pass flood flows. Approaches to the above bridges will not be inundated except Mechanic Street Bridge, and that only when Cady Brook experiences a flood with the magnitude of an Intermediate Regional Flood or greater.

Dams on the Quinebaug River

There are three dams in the reach covered by this report. Views of two dams are on Figure 4. Sandersdale Dam at station 87+50. The American Optical Company Dam at station 112+00 and the Harrington Company Dam at station 190+50 were breached or damaged during the August 1955 flood. They were reconstructed and are now capable of passing flood flows.

Table 4 lists pertinent elevations of dams and shows their relation to the Intermediate Regional and Standard Project Floods.

Obstructions to Flood Flows

The effect of obstructions due to bridges, bridge approaches and dams has been discussed in the previous paragraphs. With the exception of the bridges there are no other significant obstructions to flows in the Quinebaug River.

TABLE 4

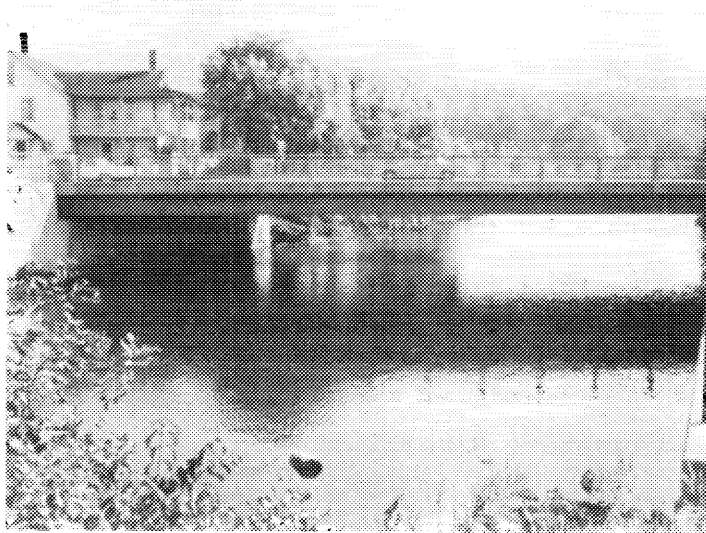
DAMS ON QUINEBAUG RIVER

<u>Station</u>	<u>Identification</u>	<u>Toe</u>	<u>Crest</u>	<u>IRF</u>	<u>SPF</u>	<u>Depth over Dam</u>	
		<u>Elev.</u>	<u>Elev.</u>	<u>Crest</u>	<u>Crest</u>	<u>IRF</u>	<u>SPF</u>
		ft. , msl	ft. , msl	ft. , msl	ft. , msl	ft.	ft.
87+50	Sandersdale		401.3	406.6	408.3	5.3	7.0
112+00	American Optical	405.7	416.5(1)	419.0(2)	419.5(2)	2.5	3.0
190+50	Harrington Co.	463.8	476.9(1)	429.4(2)	480.6(2)	2.5	3.7

(1) Flashboard Elevations

(2) Elevations in immediate vicinities of American Optial Co.

Dam and Harrington Co. Dam are indeterminate due to uncertainties regarding flashboard removal procedures during flood conditions and therefore are only estimated.



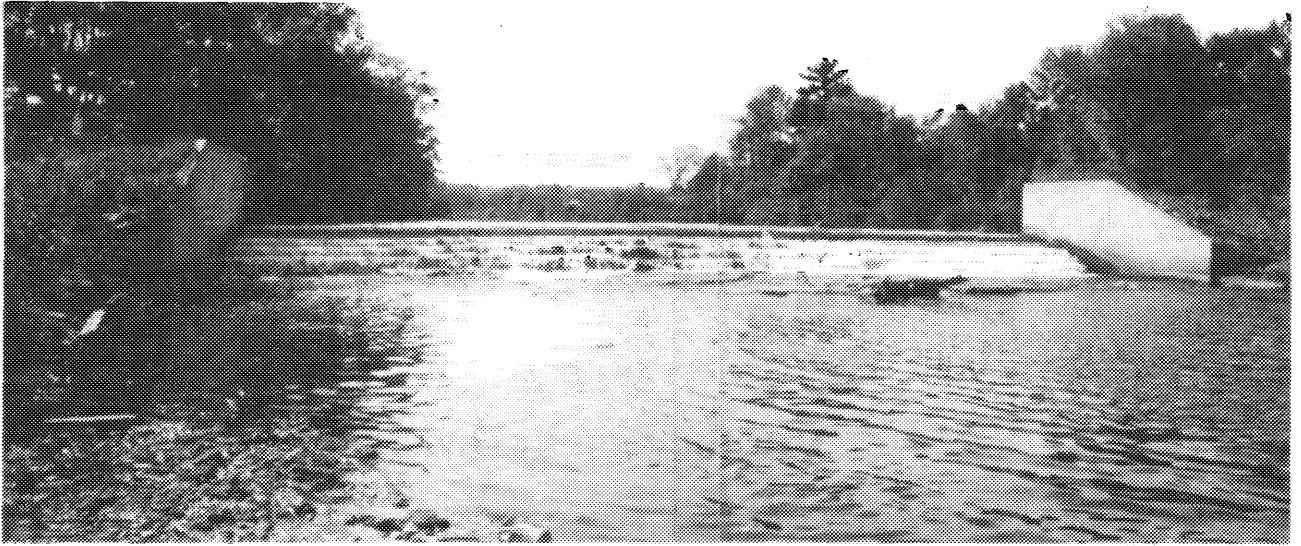
MECHANIC STREET BRIDGE



CENTRAL STREET BRIDGE

BRIDGES ACROSS QUINEBAUG RIVER

Figure 3



SANDERSDALE DAM



RUSSELL HARRINGTON DAM

DAMS ON QUINEBAUG RIVER

Figure 4

Flood Stages

Table 5 lists flood crest elevations for the known floods at highway bridges on the Quinebaug River and the elevation where flooding begins.

TABLE 5

FLOOD CREST ELEVATIONS

QUINEBAUG RIVER, SOUTHBRIDGE, MASSACHUSETTS

<u>Location</u>	<u>1936</u>	<u>1938</u>	<u>1955</u>	<u>Flooding Begins</u>
	ft., msl			ft., msl
Central St.	451.4	-	456.0	447
River St.	484.4	484.1	489.2	475
Mechanic St.	423.8	427.8	434.3	426
Dresser Hill Rd.	-	-	408.0	400

In addition to the floods listed above, historical records indicate that the upper Quinebaug River basin suffered a flood in February 1886 that was approximately equal to that of March 1936. Readings from the USGS gage at Westville have been omitted, as there has been only one flood since 1939 when the gage was installed.

TABLE 6

FLOOD CREST STAGES AND DISCHARGES
QUINEBAUG RIVER, SOUTHBRIDGE, MASS.
AT AMERICAN OPTICAL PLANT GAGE

Zero of Gage = 416.5 Feet Above Mean Sea Level

<u>Date of Crest</u>	<u>Natural</u>		<u>Modified</u>	
	<u>Stage</u> (ft.)	<u>Flow</u> c. f. s.	<u>Stage</u> (ft.)	<u>Flow</u> (c. f. s.)
March 1936	4.8	6,500	2.6	3,400
September 1938	6.8	13,000	2.6	3,400
August 1955	11.4	36,000(1)	8.1	24,500

(1) Includes dam failure on Cady Brook.

Flooded Areas, Flood Profiles and Cross Sections

Plates 3 and 4 show the approximate areas along the Quinebaug River in Southbridge that would be inundated by the Intermediate Regional, Standard Project and Modified August 1955 Floods.

The actual limits of these overflow areas on the ground may vary some from those shown on the maps because the 10 foot contour interval and scale do not permit precise plotting of the flooded areas.

The high water profiles for the Intermediate Regional Flood, the Standard Project Flood and the Modified August 1955 flood on the

Quinebaug River are also shown on Plates 3 and 4. It should be noted from the profiles that high water elevations produced by the August 1955 modified flood approximates the elevations produced by the Standard Project Flood so that the areas inundated by these two floods would have essentially the same limits. Only the smaller area inundated by the Intermediate Regional Flood is delineated on Plates 3 and 4. Also shown on the profiles are observed high water marks on the Quinebaug River for March 1936, September 1938 and August 1955 floods.

The extent of inundation in the area known as the "Flats" is due to flood water from Cady Brook as the Quinebaug River flood water alone would be confined within its banks.

Plate 7 shows typical cross sections for the Quinebaug River. The locations of these and other cross sections are indicated on Plates 3 and 4.

Flood Descriptions

Following are descriptions of known large floods that have occurred on the Quinebaug River and Cady Brook in Southbridge. These are based upon newspaper accounts, historical records and field investigations.

August 1955

The flood of August 1955 was produced when torrential rains from hurricanes fell over much of New England causing severe flooding throughout the region. Unlike the hurricanes of September 1938 and August 1954, which were notable for their high winds, the hurricanes of 1955 were noteworthy for their high amounts of precipitation. Between 11-15 August "Hurricane Connie" brought substantial amounts of rainfall to southwestern New England, but very little runoff occurred as a result of dry antecedent conditions. Approximately 5 inches of rain fell in Southbridge during this period setting the stage for what was to come later. Between 18-20 August hurricane "Diane" dumped approximately 12 inches of rain on the Southbridge area. In the neighboring town of Charlton more than 20 inches of rain fell between 11-19 of August over the headwaters of Cady Brook.

Flooding of the Quinebaug River and Cady Brook in Southbridge caused nearly 30 percent of the total damages in the Thames River basin. Southbridge industries were particularly hard hit, with losses of over 70 percent of the city total. Cady Brook, which flows southward through Charlton to the Quinebaug at Southbridge, caused heavy residential and commercial damage along its entire length.

The failure of Glenecho Dam in Charlton produced a tremendous surge that destroyed several other smaller dams in Charlton and continued unabated down Cady Brook to the Quinebaug River. In Southbridge where the drainage area of Cady Brook is 12 square miles, the peak discharge of this surge was approximately 26,300 cfs.

Based on the meager data available, the peak discharge on Quinebaug River below Cady Brook is estimated to have been between 35,000 and 40,000 cfs. The failure of Glenecho Dam on Cady Brook and of the Globe Tool and Die Company Dam on the Quinebaug River introduces a very complex hydrologic problem. So far no satisfactory analysis has been made to show the component flows in the development of the flood on the Quinebaug River from Southbridge to the town of Quinebaug, Connecticut, just below the State line.

Southbridge experienced losses of over \$18,000,000 with 350 dwellings flooded and 70 commercial establishments suffering damage ranging from flooded and silted basements to complete loss of stock, equipment and buildings. Eight highway bridges in the city were destroyed and sections of several roads were undercut and washed out.

Losses sustained by Southbridge industries amounted to over \$13,000,000. The American Optical Company, located below the confluence of Cady Brook and the Quinebaug River was particularly hard hit when the flood overtopped and breached dikes constructed by the company following the September 1938 flood.

September 1938 Flood

The flood of September 1938 resulted from three days of heavy rains preceding a disastrous hurricane which dumped a total of 13.5 inches of rainfall on the Southbridge area. The flood resulting from rainfall had already formed before the hurricane arrived. New England was experiencing heavy rainfall on September 18, 19 and 20, and streams running bank full when the rain associated with the hurricane brought the total rainfall during a 4-day period to about 17 inches in certain limited areas and to 10-14 inches in the Quinebaug River basin.

Damage was particularly severe in Southbridge where the Ames Worsted Company Dam and five small dams on branch streams failed. The large plant of the American Optical Company had 6 to 7 feet of water over its main working floors. About five other

industries also sustained large losses. Over 300 dwellings had flooded basements from overflow of brooks and backwater of the Quinebaug River. Losses sustained were close to \$950,000.

March 1936 Flood

The March 1936 floods resulted from two separate storms of March 9-13 and 16-22. The first heavy rain fell on the snow cover which had a water content of about 3-4 inches. The amount of precipitation of the first storm was notable but not extraordinary. In general it stands out only as a major contributing factor to the catastrophe that followed. The weather became unseasonably warm about March 9 and continued so during the remainder of the month. The water from the melting snows and the extraordinary rainfall of the second storm flowed into streams already burdened with the waters of the first rain, producing high stages and devastating flooding. Major losses occurred in Southbridge at the American Optical Company and the Southbridge Finishing Company plants.

February 1886 Flood

The February 1886 flood resulted from an average precipitation of over seven inches of rainfall within a three-day period. Conditions were favorable for high runoff and a flood resulted approximately equal to that of March 1936.

CADY BROOK

The Stream and Its Valley

Cady Brook begins at Glenecho Lake in Charlton, Massachusetts and flows in a southerly direction to its confluence with the Quinebaug River in Southbridge.

Developments in the Flood Plain

Development along Cady Brook is in the lower reaches of the study area and consists primarily of residential and a few manufacturing establishments.

Bridges Across the Stream

There are four highway bridges crossing Cady Brook within the town of Southbridge. Table 7 lists pertinent elevations for the bridges and shows the relation to the Intermediate Regional Flood and the experienced 1955 flood. All of the bridges will be overtopped by the Standard Project Flood which will also inundate the approaches. The footbridge will not be overtopped but access from the west will be impossible beginning with an Intermediate Regional Flood. The pipe crossing Cady Brook just below Vinton Street will not be affected by flood flows. The head loss in this area is created by the abutments of the I-beam supports. Figure 5 shows the Charlton Street and Randolph Street Bridges over Cady Brook.

Dams on Cady Brook

There are no dams on Cady Brook in the town of Southbridge.

Obstructions to Flood Flows

No other significant obstructions to flows exist other than those described in previous paragraphs.

Flood Records

There are no records of stream gages or discharges available in the lower reach where flood damages occur. Information on floods was obtained from interviews with local residents and from a search of newspaper files and historical records.

Flooded Areas, Flood Profiles and Cross Sections

The high water profiles on Cady Brook for the Intermediate Regional Flood, the Standard Project Flood and the estimated recurring August 1955 flood without dam failures and the Intermediate Regional Flood flooded areas are shown on Plates 5 and 6.

Plate 7 shows typical cross sections for Cady Brook. The location of these and other cross sections are indicated on Plates 5 and 6.

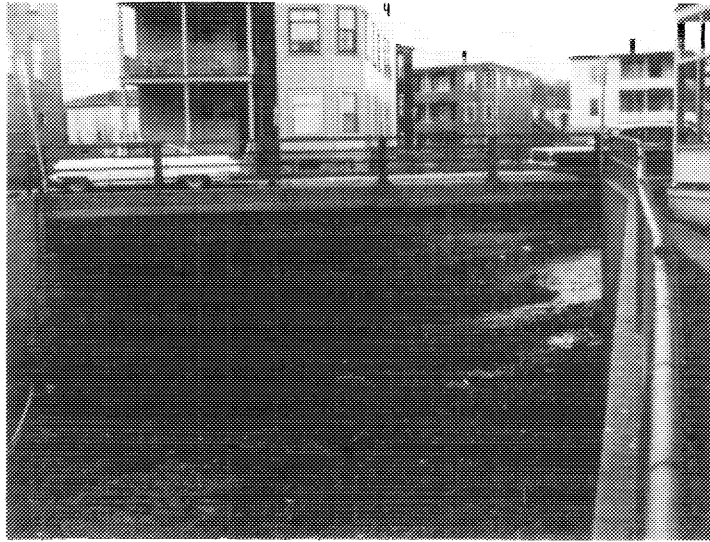
Flood Descriptions

Description of the large floods on Cady Brook are included in the discussion of past floods on the Quinebaug River.

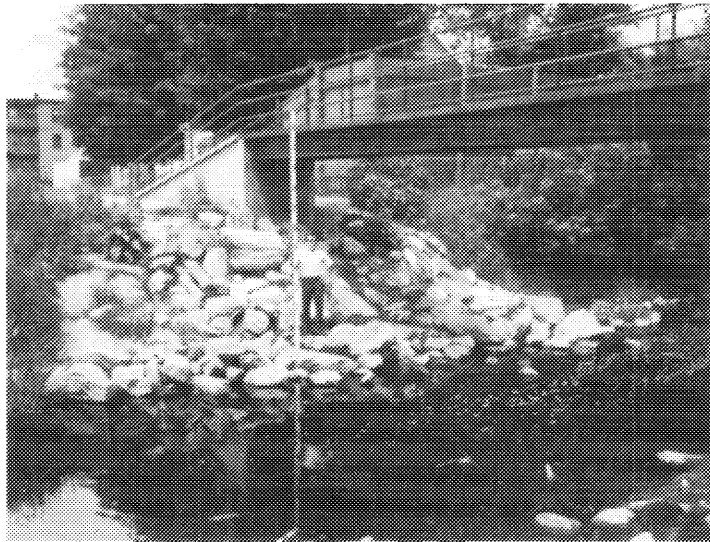
TABLE 7

BRIDGES ACROSS CADY BROOK

Station Above Mouth	Identification	Stream Bed Elev. ft., msl	Floor Elev. ft., msl	Intermediate Regional Flood Crest ft., msl	August 1955 Flood Crest ft., msl	Underclearance		
						Relation to Inter. Regional Flood Elev. ft., msl	Above ft., msl	Below ft., msl
3+50	Foot Bridge	418.0	429.0	425.0	-	427.3	2.3	-
10+00	Charlton St.	420.3	432.0	429.8	435.8	428.5	-	1.3
17+50	Randolph St.	424.9	435.4	432.8	440.5	432.8	-	-
29 46+70	9" Pipe Crossing	447.4	465.4	455.7	-	462.1	6.4	-
53+00	Vinton St.	453.5	465.2	467.0	-	463.4	-	3.6
91+80	Brookside Road	478.0	490.4	493.0	-	487.1	-	5.9



CHARLTON STREET BRIDGE



AMERICAN OPTICAL FOOTBRIDGE

BRIDGES ACROSS CADY BROOK

Figure 5

FUTURE FLOODS

This section of the report discusses the Standard Project Flood and the Intermediate Regional Flood on the Quinebaug River and Cady Brook in the vicinity of Southbridge, Massachusetts. Floods the size of the Standard Project Flood represent reasonable upper limits of expected flooding. Floods of the size of the Intermediate Regional Flood represent floods that may reasonably be expected to occur more frequently, although they will not be as high as the infrequent Standard Project Flood.

DETERMINATION OF INTERMEDIATE REGIONAL FLOOD

The Intermediate Regional Flood is defined as a flood having an average frequency of occurrence in the order of once in 100 years at a designated location, although the flood may occur in any year. For this reason, the Intermediate Regional Flood is better described as a flood with a 1 percent chance of occurring each year.

The Intermediate Regional Flood discharges for the Quinebaug River and Cady Brook in Southbridge were derived from information compiled following the record flood of August 1955 and during the design studies for Westville and East Brimfield Reservoirs. Adopted peak discharges for the Intermediate Regional Floods on the Quinebaug River and Cady Brook are shown in Table 8.

Results of this study indicate that at River Street Bridge an Intermediate Regional Flood would be 0.9 feet lower than the modified 1955 flood stage and 1.2 feet lower at Central Street Bridge. Downstream at Dresser Hill Road the Intermediate Regional Flood is 1.6 feet lower than the modified 1955 flood.

TABLE 8
INTERMEDIATE REGIONAL FLOODS

<u>PEAK DISCHARGES</u>				
<u>Stream</u>	<u>Location</u>	<u>River Station</u>	<u>Drainage Area sq. mi.</u>	<u>Discharge c.f.s.</u>
Quinebaug R.	Westville Dam	252+00	99.5	2500
"	Harrington Co. Dam	190+50	106.0	2600
"	Above Cady Brook	141+00	122.0	5500
"	American Optical Dam	112+00	126.0	6300
"	Sandersale Dam	87+50	136.0	6300
"	Southbridge-Dudley Town Line	0+00	146.0	9100
Cady Brook	Mouth	0+00	13.0	4200

DETERMINATION OF STANDARD PROJECT FLOOD

The largest flood that is likely to occur on a specific stream has been experienced only in rare instances. The Corps of Engineers, in cooperation with the National Weather Service, has made broad and comprehensive studies and investigations based on the vast records of experienced storms and floods and has evolved generalized procedures for estimating the flood potential of streams. These procedures have been used in determining the

Standard Project Flood. It is defined as the largest flood that can be expected from the most severe combination of meteorological and hydrological conditions that are considered reasonable characteristics of the geographical regions involved. Adopted peak discharges of the Standard Project Floods on the Quinebaug River and Cady Brook are shown in Table 9.

A Standard Project Flood has been estimated for the Quinebaug River. It is assumed that this flood would be about the same as the modified August 1955 flood at River Street and 0.6 foot higher at Central Street Bridge. Downstream at Dresser Hill Road the Standard Project Flood is 0.4 foot higher than the modified August 1955 flood. The Standard Project Flood would be much higher if it wasn't for the two flood control dams at Westville and East Brimfield. The dams will be operated to reduce flows during heavy rains or when there is a large amount of runoff from snowmelt and precipitation.

Frequency

It is not practical to assign a frequency to the Standard Project Flood. The occurrence of such a flood would be a rare event. however it could occur in any year.

TABLE 9
STANDARD PROJECT FLOODS

PEAK DISCHARGES

<u>Stream</u>	<u>Location</u>	<u>River Station</u>	<u>Drainage Area sq. mi.</u>	<u>Discharge c. f. s.</u>
Quinebaug R.	Westville Dam	252+00	99.5	2500
"	Harrington Co. Dam	190+50	106.0	4000
"	Above Cady Brook	141+00	122.0	8300
"	American Optical Dam	112+00	126.0	9600
"	Sandersdale Dam	87+50	136.0	9600
"	Southbridge-Dudley Town Line	0+00	146.0	13500
Cady Brook	Mouth	0+00	13.0	6500

Possible Larger Floods

Floods larger than the Standard Project Flood are possible; however, the combination of factors that would be necessary to produce such floods would seldom occur. For this reason, floods of this magnitude have not been considered in this report.

HAZARDS OF GREAT FLOODS

The amount of damage caused by any flood depends upon how much area is flooded and the height of flooding.

Areas Flooded and Heights of Flooding

The areas along Quinebaug River and Cady Brook flooded by the Intermediate Regional and the Standard Project Floods are shown on Plates 3 through 6. Elevations of flow can be estimated from the profiles which are shown on the same plates.

The profiles for the rivers were computed by using stream characteristics for selected reaches as determined from observed flood profiles, flood high water marks, topographic maps and back water curves. The overflow areas and the elevations shown on Plates 3 through 6 have been determined with an accuracy consistent with the purposes of this study and the accuracy of the basic data.

The profiles of the Intermediate Regional and the Standard Project Floods depend in part upon the degree of destruction or clogging of various bridges during the flood. Because it is impossible to forecast these events, it is assumed that all bridge structures will stand and that no clogging will occur.

Figure 6 shows the heights that would be reached by the Intermediate Regional and the Standard Project Floods on facilities presently existing within the flood plain in the vicinity of Southbridge.



QUINEBAUG RIVER - Flood Height at Building below
Dresser Hill Road Bridge



CADY BROOK - Flood Heights at Corner of Randolph
and Green Streets

FLOOD HEIGHTS

Figure 6

GLOSSARY OF TERMS

Flood. An overflow of lands not normally covered by water and that are used or usable by man. Floods have two essential characteristics: the inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river or stream or an ocean, lake, or other body of standing water.

Normally a "flood" is considered as any temporary rise in stream flow or stage, but not the ponding of surface water, that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, rise of ground water coincident with increased stream flow, and other problems.

Flood Crest. The maximum stage or elevation reached by the waters of a flood at a given location.

Flood Peak. The maximum instantaneous discharge of a flood at a given location. It usually occurs at or near the time of flood crest.

Flood Plain. The relatively flat area or low lands adjoining the channel of a river, stream or watercourse or ocean, lake, or other body of standing water, which has been or may be covered by flood water.

Flood Profile. A graph showing the relationship of water surface elevation to location, the latter generally expressed as distance above mouth for a stream of water flowing in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

Flood Stage. The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

Head Loss. The effect of obstructions, such as narrow bridge openings or buildings that limit the area through which water must flow, raising the surface of the water upstream from the obstruction.

Intermediate Regional Flood. A flood having an average frequency of occurrence in the order of once in 100 years although the flood may occur in any year. It is based on statistical analyses

of streamflow records available for the watershed and analyses of rainfall and runoff characteristics in the "general region of the watershed".

Left Bank. The bank on the left side of a river, stream, or water course, looking downstream.

Low, Steel (or Underclearance). See "underclearance".

Right Bank. The bank on the right side of a river, stream, or watercourse, looking downstream.

Standard Project Flood. The flood that may be expected from the more severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations. Peak discharges for these floods are generally about 40% to 60% of the Probable Maximum Floods for the same basins. Such floods, as used by the Corps of Engineers, are intended as practicable expressions of the degree of protection that should be sought in the design of flood control works, the failure of which might be disastrous.

Underclearance. The lowest point of a bridge or other structure over the main channel of a river, stream or watercourse. This is referred to as "low steel" in some regions.

AUTHORITY, ACKNOWLEDGEMENTS AND INTERPRETATION
OF DATA

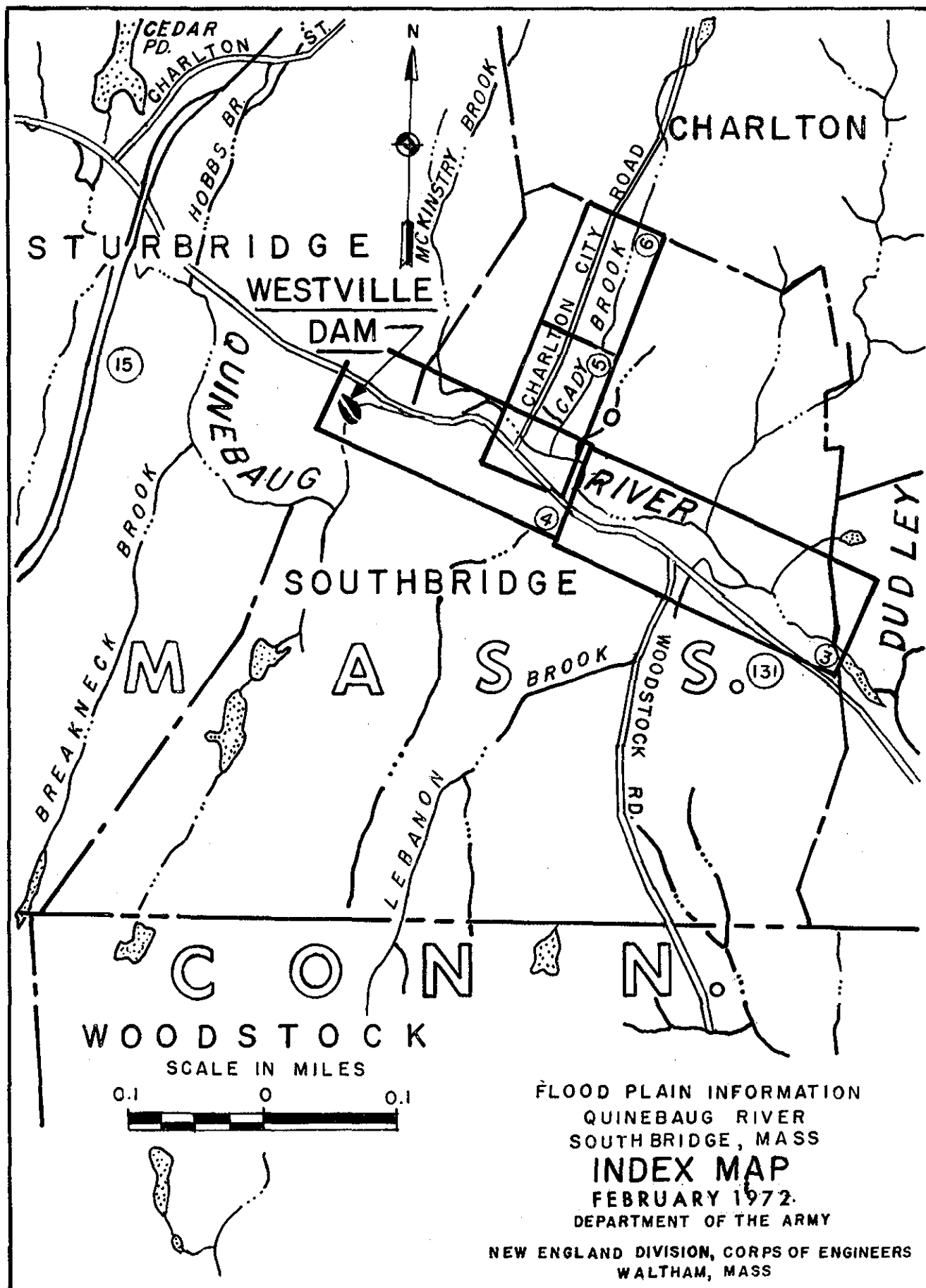
This report has been prepared in accordance with the authority granted by Section 206 of the Flood Control Act of 1960 (P. L. 86-645) as amended.

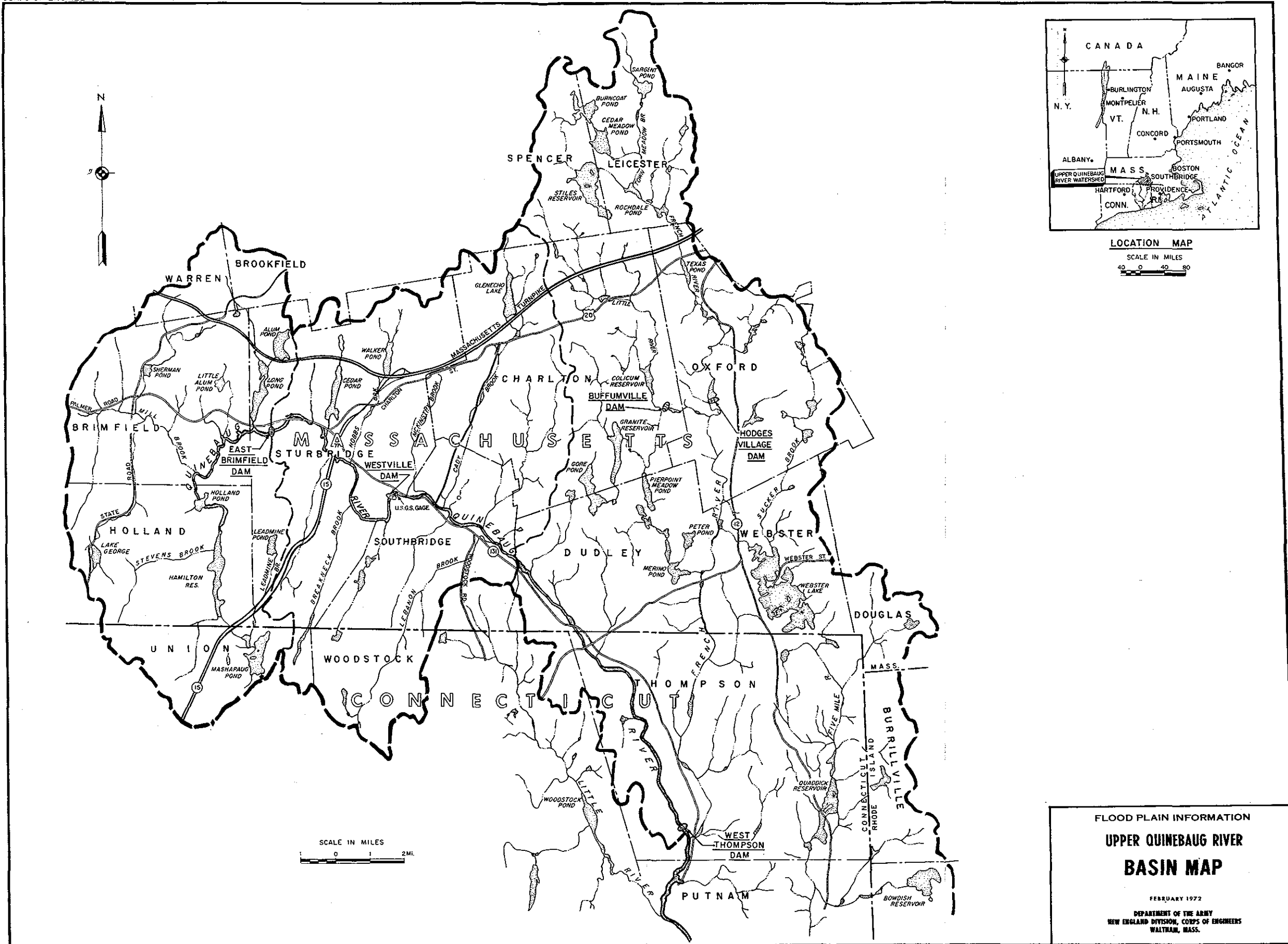
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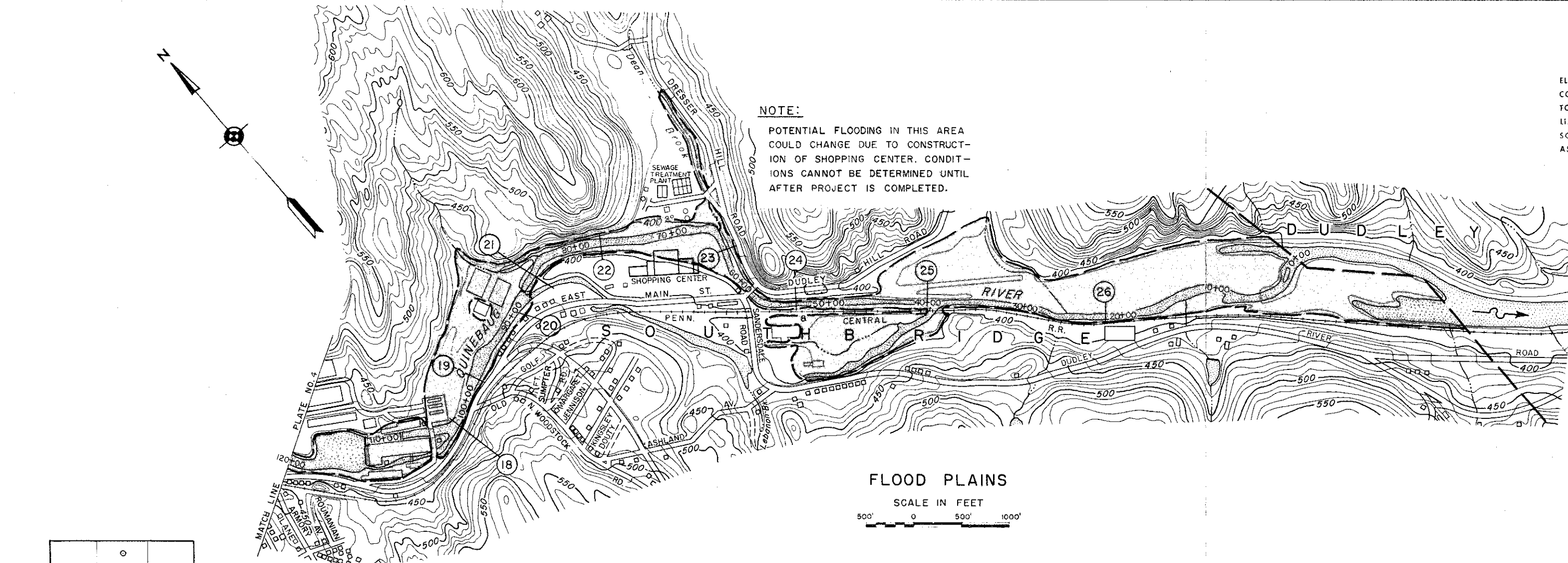
Assistance and cooperation of the U.S. National Weather Service, U.S. Geological Survey, Massachusetts Water Resources Commission, Massachusetts Department of Public Works, Town of Southbridge and private citizens in supplying useful data are appreciated.

* * *

This report presents the local flood situation for Southbridge, Massachusetts. The New England Division of the Corps of Engineers will provide technical assistance in application of data presented herein.





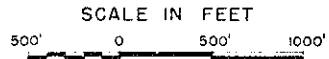


NOTE:
POTENTIAL FLOODING IN THIS AREA
COULD CHANGE DUE TO CONSTRUCT-
ION OF SHOPPING CENTER. CONDIT-
IONS CANNOT BE DETERMINED UNTIL
AFTER PROJECT IS COMPLETED.

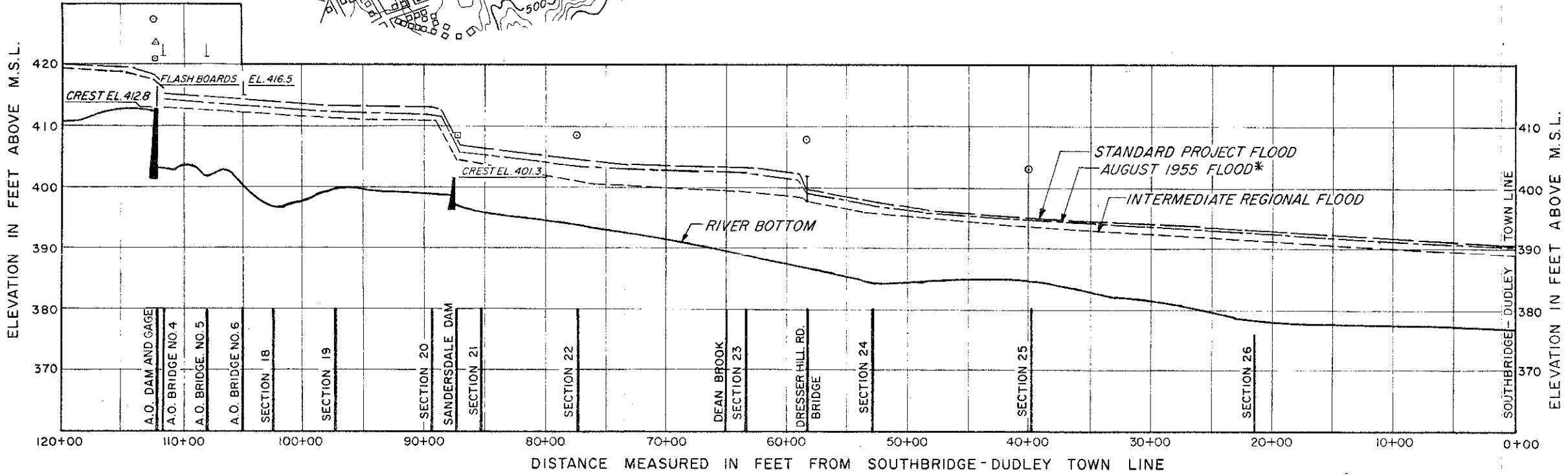
NOTES
ELEVATIONS REFER TO MEAN SEA LEVEL DATUM.
CONTOUR INTERVAL EQUALS TEN FEET.
TOPOGRAPHY IS BASED ON U.S.G.S. MAPS.
LIMITS OF OVERFLOW INDICATED MAY VARY
SOME FROM ACTUAL LOCATIONS ON GROUND
AS EXPLAINED IN THE REPORT.

- LEGEND**
- AUGUST 1955 HIGH WATER MARK
 - △ SEPTEMBER 1938 HIGH WATER MARK
 - MARCH 1936 HIGH WATER MARK
 - I BRIDGE
 - └ LOW STEEL
 - ▬ DAM
 - ⊙ RIVER CROSS SECTION
 - * MODIFIED BY EAST BRIMFIELD AND WESTVILLE FLOOD CONTROL RESERVOIRS

FLOOD PLAINS



▬ NORMAL FLOW
▬ INTERMEDIATE REGIONAL FLOOD
(Standard Project Flood Covers Approx. The Same Area)



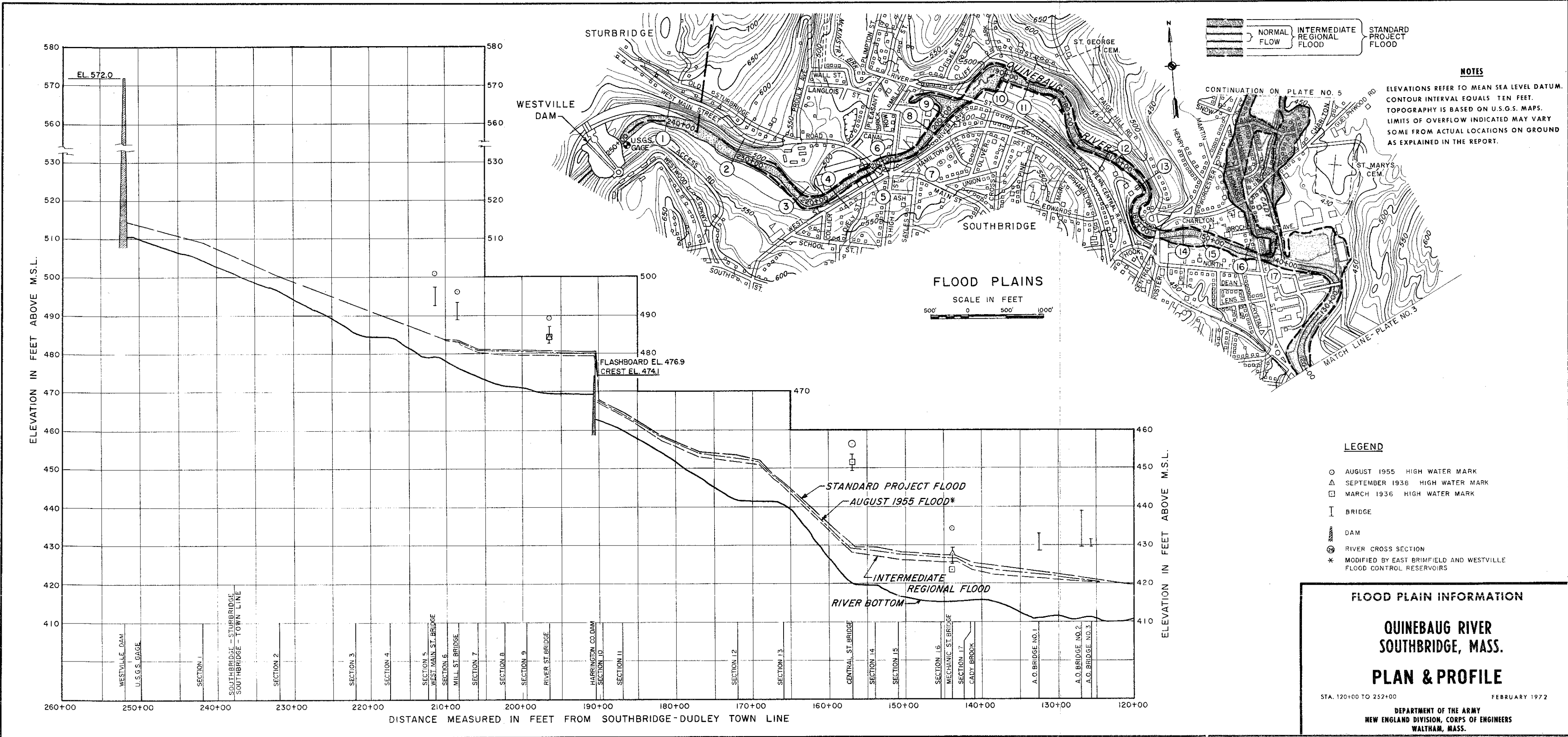
FLOOD PLAIN INFORMATION

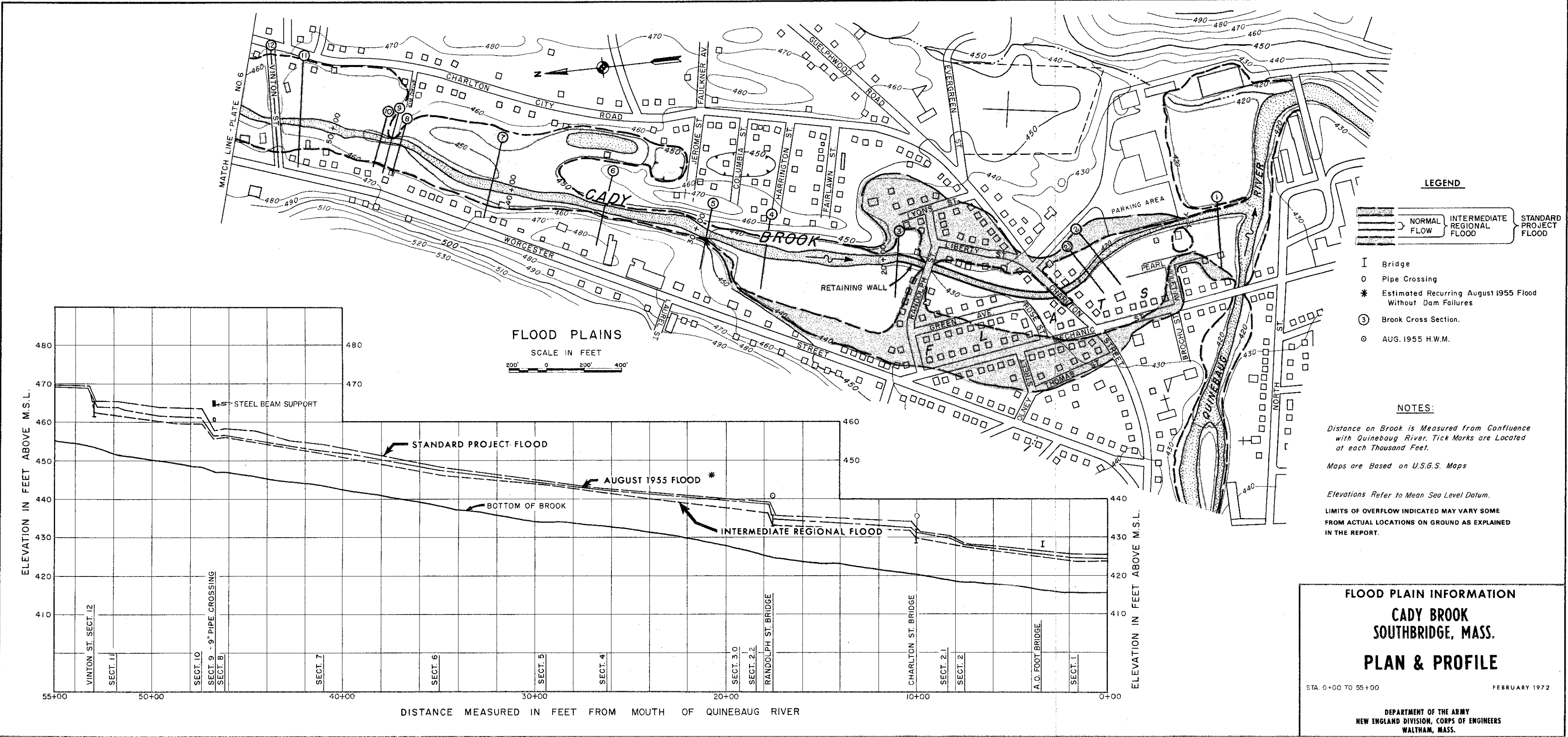
**QUINEBAUG RIVER
SOUTHBIDGE, MASS.**

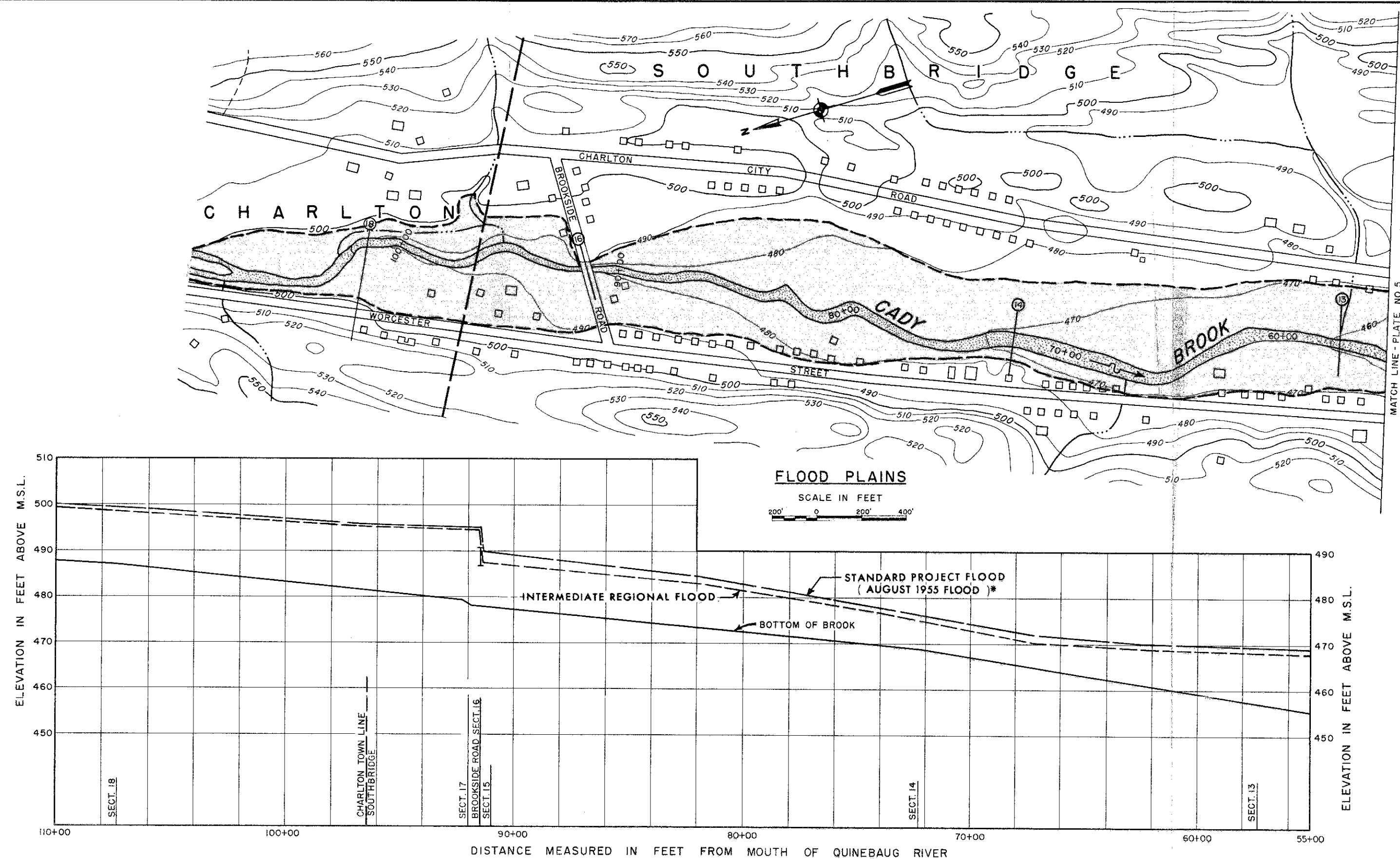
PLAN & PROFILE

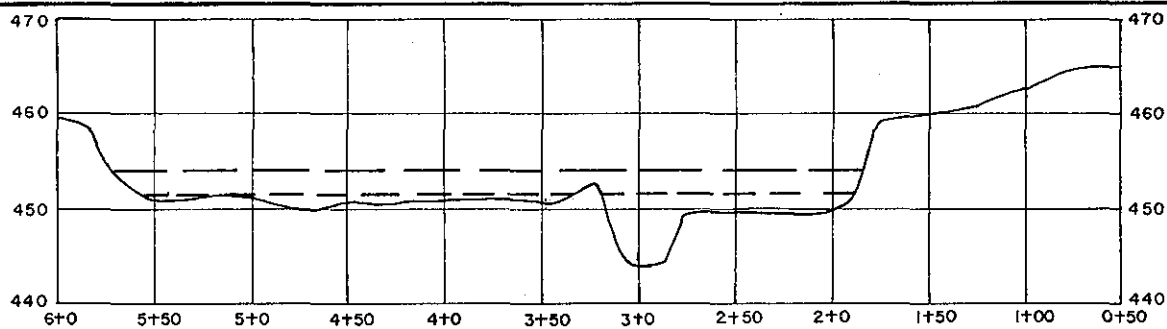
STA. 0+00 TO 120+00 FEBRUARY 1972

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NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

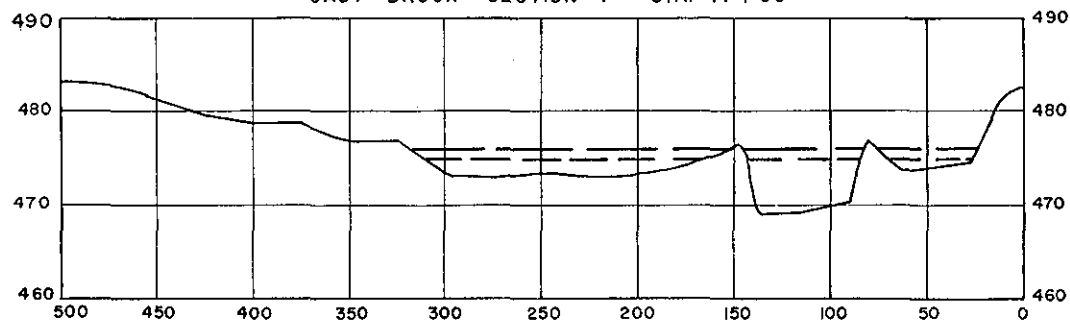




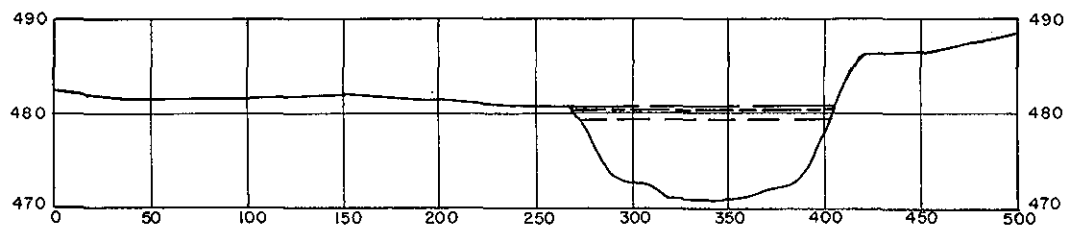




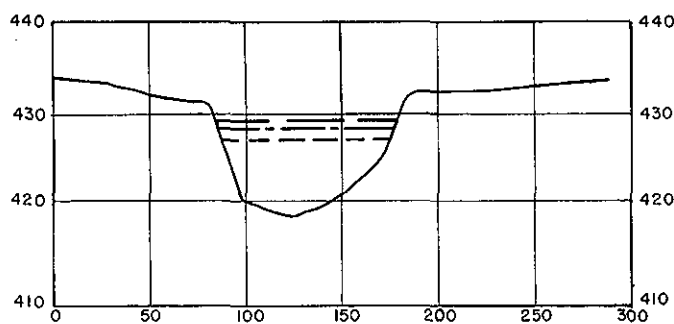
CADY BROOK SECTION 7 STA. 41+00



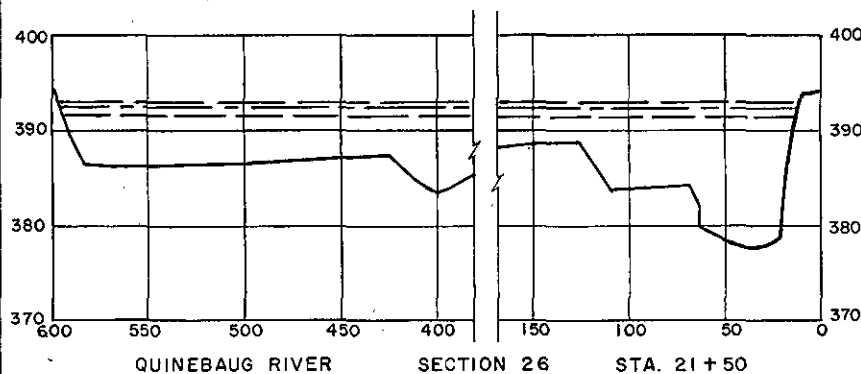
CADY BROOK SECTION 14 STA. 72+30



QUINEBAUG RIVER SECTION 9 STA. 199+50



QUINEBAUG RIVER SECTION 14 STA. 154+00



QUINEBAUG RIVER SECTION 26 STA. 21+50

LEGEND

- STANDARD PROJECT FLOOD
- - - AUG. 1955 FLOOD (MODIFIED BY EXISTING DAMS)
- · - INTERMEDIATE REGIONAL FLOOD

NOTES

Elevations refer to feet above mean sea level.
Horizontal distances are in feet.
Sections taken looking down stream

FLOOD PLAIN INFORMATION
QUINEBAUG RIVER & CADY BROOK
SOUTHBRIDGE, MASSACHUSETTS

TYPICAL CROSS SECTIONS

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